A PRELIMINARY REPORT ON THE PLANKTON OF THE WEST COAST OF FLORIDA

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INTRODUCTION

At intervals from November, 1946 to September, 1947, the Gulf coastal waters of Southwest Florida were discolored by the tremendous abundance of a dinoflagellate which was described (Davis, 1948a) as *Gymnodinium brevis*, a species new to science. This condition of red water, or "red tide", as it was called, was accompanied by heavy mortality of fish and invertebrates (Gunter et al., 1947, 1948; Florida State Board of Conservation, 1948; Galtsoff, 1948, 1949). Previous to this, irregularly occurring outbursts of red water have been recorded for the Florida West Coast since 1840. Somewhat similar outbreaks of red water have appeared in many parts of the world.

To investigate the causes of this plankton phenomenon, the United States Fish and Wildlife Service has established a laboratory at Sarasota, Florida. The program of research includes an ecological study of the biological, chemical and physical nature of Gulf coastal water with the object of determining what peculiar condition or combination of conditions may result in an overproduction of dinoflagellates. Another phase of the work being carried out at this laboratory by personnel of the University of Miami, is a study of methods for growing red water-producing organisms under controlled, laboratory conditions to determine their nutritional requirements (G. S. King, 1949).

The purpose of this paper is to describe, in general, the plankton forms characteristic of the coastal waters of this area, more specifically the dinoflagellates and—that interesting class of zooplankton—the copepods. The work to be described was conducted over a period of about ten months (January to October, 1949). No attempt has been made to work out cycles of abundance or sequences of plankton associations from data collected in so limited a time. One chief objective is to show what might be termed

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the normal or typical plankton picture prevailing during this period.

Methods

At the initiation of the "red tide" investigation it was decided to establish a series of stations at points representing estuary, bay, coastal, and offshore environments, which were to be visited at regular intervals over an extended period. As shown in Fig. 1 and Table 1, the stations are located adjacent to the Boca Grande area—an area which has been associated with the origin of the recent red tides. At each occupation of a station, numerous chemical and physical measurements are made and a plankton collection is obtained. In addition to visits to the established stations, trips have been made to other parts of the coast, and plankton collections taken whenever opportunity permitted. The locations of these additional collection points are also shown in Fig. 1 and Table 2.

The collections were, for the greater part, made by towing from a motor vessel of the Fish and Wildlife Service, the *Pompano*. At New Pass, Sarasota, however, the samples were taken from a bridge during a change of tide when there was sufficient current to distend the net. At Stations 1 and 2, which could not be easily reached with the vessel, the current was never strong enough to support the net; so here it was necessary to walk along the bridges pulling the net by hand.

For making quantitative tows the Clarke-Bumpus Plankton Sampler was used (Clarke and Bumpus, 1940). This instrument appears to be the most satisfactory closing-net type of quantitative plankton sampler that has been produced. It consists mainly of a brass tube, 5 inches in diameter, to one end of which is attached the cone-shaped net. Within the tube is mounted a propeller which is geared to a counter that registers the number of revolutions and consequently the volume of water passing through the tube and the net. A disk-shaped messenger-controlled shutter is mounted on the front end of the tube thereby permitting the operator to open and close the sampler at any desired water level.

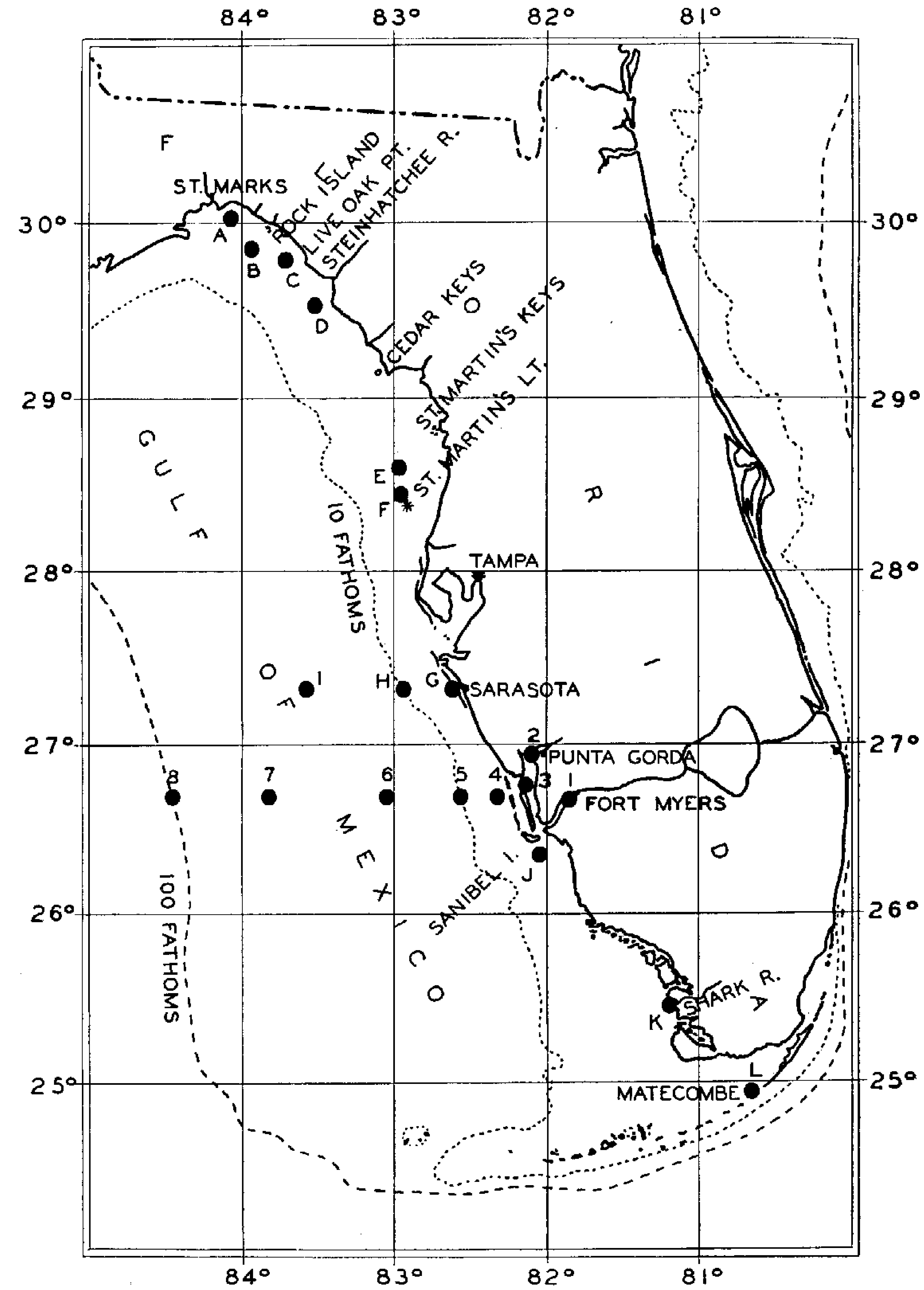

Figure 1. Map of peninsular Florida showing the locations of Stations 1 to 8 and other localities A to L where plankton collections were taken.

TABLE I—Data Pertaining to the Established Stations in the Caloosahatchie River, Peace River, Charlotte Harbor, and Coastal and Offshore Gulf Waters West of Boca Grande.

Station Number	LOCATION	Depth of Water	Range of Surface Salinity*	Number of Times Visited (May to October, 1949)
1	Mid-channel, Caloosahatchie River at Fort Myers	1½ fathoms	0.0 to 29.96 ‰	7
2	Mid-channel, Peace River at Punta Gorda	2 fathoms	0.0 to 29.20 ‰	7
3	Lower bay, Charlotte Harbor	2 fathoms	12.00 to 37.09 ‰	7
4	First channel marker buoy inside Boca Grande Sea Buoy	5 fathoms	25.23 to 35.90 ‰	7
5	12 miles west Boca Grande Sea Buoy	10 fathoms	31.35 to 35.70 ‰	7
6	37 miles west Boca Grande Sea Buoy	20 fathoms	34.94 to 35.97 ‰	6
7	80 miles west Boca Grande Sea Buoy	40 fathoms	33.17 to 36.64 ‰	6
8	110 miles west Boca Grande Sea Buoy	100 fathoms	32.95 to 36.13 ‰	3

*These salinity data were supplied by D. Q. Anderson, formerly Oceanographer, and J. M. Amison, Chemist, Gulf Investigations, U. S. Fish and Wildlife Service, Sarasota, Florida.

TABLE 2—Location of Collecting Points, A to L, as Shown on Figure 1, and Dates Visited

Collection Point	LOCATION	Depth of Water	Date of Visit
A	5 miles S.E. St. Mark's Light	2 fathoms	September 11, 1949
B	S.W. Rock Island	2 fathoms	September 9, 1949
C	W. Live Oak Point	2 fathoms	September 12, 1949
D	S.W. Steinhatchee River	2½ fathoms	September 13, 1949
E	S.W. St. Martin's Keys	2 fathoms	September 8, 1949
F	Near St. Martin's Light	2½ fathoms	September 14, 1949
G	New Pass, Sarasota	2 fathoms	Sampled numerous times, January to August, 1949
H	Off Sarasota	10 fathoms	April 22, 1949
I	Off Sarasota	25 fathoms	April 21, 1949
J	Just off Sanibel Light	2 fathoms	January 19, 1949
K	Mouth of Shark River	2 fathoms	January 18, 1949
L	Florida Bay, just off Matecombe Key	1½ fathoms	January 15, 1949

Before using a sampler for quantitative work it is necessary that the instrument be calibrated in terms of liters of water filtered per revolution of the propeller. Lacking the proper equipment for this calibration, a method was devised of towing the sampler, minus the net, at a standard towing speed over a measured distance between two channel markers. Presumably, for practical purposes, all the water in a column with a length equal to the measured distance and a diameter of 5 inches, passed through the sampler. When our two samplers were first acquired, they were each calibrated at 4.5 liters per revolution of the propeller. After three months of use they were recalibrated at 4.5 liters for one sampler and 4.6 liters for the other.

The samplers are towed from the vessel by a ⅛ inch stainless steel cable. To the end of the cable is attached a 100 pound streamlined lead weight, and the sampler mounted about 18 to 24 inches above the weight. With this type of weight there is never any twisting of the line or fouling of the net, and the poundage is sufficient to reduce the wire-angle, or "angle-of-stray", to a negligible amount. It is essential that this angle be less than 5° if the messenger is to make proper contact with the shutter-tripping mechanism of the sampler. The manufacturer of the sampler has supplied us with a trigger extension which partially corrects this situation and permits operation of the sampler with a wire-angle of 15° to 20°.

Since the Sarasota laboratory is without adequate personnel and facilities for examining large volumes of plankton material, plankton sampling has been limited to one 20 to 30 minute oblique tow at each station. Such a tow gives a complete plankton picture at any one point but of course does not provide material for studies of plankton stratification or vertical migrations.

Since an important purpose of this study concerned dinoflagellates, which are representative of the smallest forms of aquatic life, it was initially planned to use very fine nets of No. 25 mesh (200 meshes per linear inch). After some experience it was found that in cases of high phytoplankton density the meshes of these fine nets were soon clogged and backwash from the filled net appeared to turn the propeller in reverse so that at the end of a tow the counter reading would be less than at the start. This problem was seldom encountered with a No. 20 (173 meshes to the linear

inch) mesh net which is now used in areas with abundant phytoplankton, such as the bay and coastal waters. The No. 25 mesh nets are reserved for the offshore waters where phytoplankton is relatively scarce.

It is known that many of the very minute plankton organisms (the *nannoplankton*) are lost with even the finest-meshed nets. This loss has been variously computed by different observers as being from 2% to 50%. For the purpose of determining the true abundance of this nannoplankton, unconcentrated water samples taken from the reversing water bottle are placed in glass-stoppered bottles. As soon as possible after returning to the laboratory, these samples are concentrated by centrifuging and the solids examined microscopically. An attempt is made to identify the organisms present and estimate their relative abundance.

Both the net and the water-bottle samples are preserved in formalin. At the laboratory the net collections are concentrated by centrifuging in graduated, narrow-tipped tubes and the displacement volume of the plankton solids measured and recorded. Much of the supernatant liquid is then pipetted-off, the total volume of the concentrate being reduced to 50 to 300 ml. depending upon the volume of the solids present. All samples are centrifuged for 5 minutes at 2000 RPM.

Before making the count, portions of the concentrate are examined in a watch glass and on a glass slide under a coverglass and the organisms identified to the best of the investigator's ability. Copepods or other forms requiring dissection for accurate identification, are transferred to a drop of glycerine on a slide. The viscous and non-volatile nature of glycerine makes it a good medium for the dissection and for storage of the organisms for later reference. The author has found that this preliminary examination always yields a much longer list of species than does the differential plankton count which follows.

In making the plankton count, 1 ml. of the thoroughly mixed concentrate is transferred to a standard 20 X 50 mm., Sedgewick-Rafter type, counting cell and sealed with a cover glass. A differential count of all organisms in ten ocular fields, chosen at random, is made using a compound, binocular microscope equipped with a mechanical stage and a Whipple type micrometer eyepiece.

A "survey" count is also made. In this count the large plankters, such as copepods, *Appendicularia*, shrimp larvae, etc., are counted in 1/10, or 1/2 of the cell, or the entire cell. These large plankters generally occur in such sparse numbers that a much larger volume of concentrate than ten ocular fields must be examined in order to secure an adequate measure of their abundance.

From the results so recorded, the number of plankters per liter of water may be computed by use of the following formula (from Welch, 1948):

$$N = \frac{wc}{l} + \frac{(a1000c)}{l}$$

in which w = number of large plankters enumerated in survey count of entire cell.

c = volume of concentrate in milliliters.

l = volume of water strained in liters.

a = average number of plankters per cu. mm. of counting cell.

Tabulation of the count may be facilitated by using mimeographed sheets bearing the names of commonly appearing forms each followed by ten spaces for recording the results of the ten ocular counts and an additional space for the survey count.

Composition of the Plankton

Phylum Thallophyta

Class Cyanophyceae. Of the blue-green algae only Trichodes-*mium erythraeum* and *Microcoleus sp.* (*tenerrimus?*) were common to abundant in the brackish-water of Stations 1 and 2. *T. erythraeum* was the only form commonly occurring in the bay, coastal and offshore areas. From the middle of February to the middle of August, dense blooms of *T. erythraeum* appeared sporadically along the coast between Sarasota and Boca Grande. At the height of a bloom the alga appeared as a yellowish, flocculent material, concentrated in the upper meter of water and commonly aligned in windblown streaks on the surface. As the peak of the growth is passed the plant masses become reddish-brown and a chlorine-like odor is strongly evident throughout the area. Although the alga was present in almost all collections taken, it was observed in a "bloom" abundance only within 35 miles of the shore and

most commonly just off the beaches. The plant has been well termed "sea sawdust" by sailors.

Class Bacillariophyceae. Diatoms occur abundantly in both fresh and salt water, appearing in great diversity of form and size. They are considered the most important group of plants in the sea as they are the true "producers" and are the chief food of the zooplankton and the higher plankton-feeding animals such as the sardine fishes. In the inside waters the most abundant forms are species of *Coscinodiscus, Skeletonema, Navicula, Nitzschia* and *Surirella.* With the exception of *Surirella,* these genera are also represented in the coastal waters together with *Rhizosolenia* and *Chaetoceros.* In the offshore waters of the open Gulf we have found all forms of phytoplankton to be very scarce. Several diatom genera are represented, the most common being *Chaetoceros, Rhizosolenia,* and *Thalassiothrix,* but none occurring in any abundance. An interesting diatom of the offshore areas is *Chaetoceros coarctatus* which was never encountered without its attached aggregation of *Vorticella,* a ciliate protozoan.

Class Chlorophyceae. The green algae are characteristic of fresh water but sparsely represented in the sea. At the fresh to brackish water Stations 1 and 2, the commonly appearing forms were *Pediastrum, Micrasterias, Scenedesmus,* and *Staurastrum.* No planktonic green algae were found at Stations 3 to 8.

Phylum Protozoa

Class Mastigophora. The class is best represented in brackish and salt water by the dinoflagellates. On July 29, 1949, a reddish-brown film was noticed occurring in scattered patches and streaks over the surface of Sarasota Bay. Schools of mullet were following the reddish streaks and appeared to be actively feeding on the surface film. A sample of the water examined under the microscope, was found to be swarming with a species of *Gonyaulax.* In the same locality on August 16, 1949, there was a reoccurrence of the "red water". Again the mullet seemed to be taking advantage of this supply of concentrated food. On this occasion the surface water contained *Gonyaulax triacantha, Gonyaulax* sp., *Polykrikos* sp. (*schwartzi?*), *Cochlodinium* sp. (*virescens?*), *Gymnodinium* sp. (*nelsoni?*), *Ceratium furca,* and *Dinophysis sp.* Although there had been considerable rainfall during the preceding two or three days, the salinity of the bay water was 26.8 ‰.

A plankton sample taken July 17, 1949, at Station 1 was very rich with *Gonyaulax sp.* Except for these three occasions dinoflagellates were never found in abundance in the plankton samples, although *Gymnodinium* sp., *Peridinium sp.*, and two or three species of *Ceratium* were usually present. Water samples from the river, bay and coastal areas, out to Station 5, usually yielded large numbers of *Gymnodinium simplex* when cultured in the laboratory.

Class Sarcodina. The skeletal structures of Foraminifera and Radiolaria are important elements in the composition of marine bottom sediments. Representatives of these orders were never taken in abundance, but were present in small numbers in the majority of the collections, particularly those from the more saline areas.

Class Ciliata. Samples of river, bay and coastal water, when cultured in the laboratory, usually produced an abundance of the ciliate *Plagiocampa marina* (Order Holotricha) which has been previously reported for the Florida Coast (Noland, 1936-37). Tintinnids (Order Spirotricha) of a variety of species, were repeatedly present in collections ranging from brackish river water to the offshore waters of the Gulf. At certain times, particularly in the bay and coastal water, they occurred in sufficient numbers to be an important element in the composition of the plankton. The genus *Euplotes* (Order Spirotricha) was represented in a few collections from scattered points ranging from the river stations to the 100 fathom station.

Phylum Coelenterata.

Some of the most remarkable specializations of this phylum occur in the Siphonophora; the best known of these are the Portuguese Man-of-War (*Physalia pelagica*) and *Velella*, which were observed on almost every trip made to the 100 fathom line. The varieties of Siphonophora most frequently taken in the plankton net are without floats and depend entirely on "swimming-bells" to keep their colonies near the surface. One of the most commonly occurring species closely resembles *Diphyes bipartita.*

Medusae were found in almost all the plankton collections but never in abundance.

Phylum Ctenophorae

"Comb-jellies" were seen on numerous occasions in the coastal waters but were not taken in the plankton tows.

Phylum Platyhelminthes

Although most of the Turbellaria are bottom-dwelling, a small free-swimming form frequently appeared in the plankton.

Phylum Rotatoria

Several species of Rotifera were present in practically every sample from the brackish waters of Stations 1 and 2, but none were encountered in the more saline areas.

Phylum Chaetognatha

The "arrow-worms" are a common element of the plankton and were taken in all areas sampled. Species of *Sagitta,* resembling *elegans* and *bipunctata,* were found at all Stations 1 to 8. A form identified as *S enflata* was common at Stations 5 to 8.

Phylum Echinodermata

The pluteus larva of the sea urchin and the bipinnaria larva of the starfish were characteristic elements in the plankton of the open Gulf, but were not taken in the inside waters.

Phylum Annelida

Although the segmented worms are mostly bottom-living in habit, their larval stages are prominent in the plankton of coastal waters. On one occasion a sample taken at New Pass, Sarasota, was actually swarming with *Chaetopterus* larvae. Our records show few plankton tows that failed to yield numerous annelid larvae.

Phylum Arthropoda

Order Cladocera. Although prominent in fresh water plankton, only a few genera of Cladocera are reported to occur in the sea. The common genera, *Bosmina, Chydorus* and *Camptocercus* were found in collections from Station 1 when the estuary was practically fresh. In the more saline areas the salt water genus, *Evadne,* was well represented and on a few occasions, *Podon* was taken. Another cladoceran found consistently in the brackish and salt water collections was identified as a species of *Diaphanosoma* which according to the available literature is considered a fresh water inhabitant.

Subclass Ostracoda. Ostracods were found in the fresh to brackish water of the inside stations and in the saline water of the Gulf from 10 to 100 fathoms. For some reason, however, none was taken in the intermediate environment of the lower bay and coastal areas. This group always made up a relatively small proportion of the plankton.

Subclass Cirripedia. Barnacle larvae were found at the inside stations and in the Gulf out to 10 fathoms. They were consistently present within these limits but never in any abundance.

Subclass Copepoda. The copepods are the most abundant of all crustaceans and are the dominant zooplankton form in our collections. As there are but few published reports dealing specifically with copepod collections from the Gulf area (Herrick, 1887; Foster, 1904; Marsh, 1926; Davis, 1947, 1948; Penn, 1947; M. S. Wilson, 1949) the author made a particular effort to identify this group as completely as was possible with the available time and literature. Since Jan. 1, 1949, 67 species and seven additional genera have been identified with fair certainty. Of these only 11 species are mentioned in the references cited above. A few specimens do not agree completely with the species descriptions, but the shortage of time and lack of local library facilities have not made it possible for the author to completely review the wealth of literature dealing with the Copepoda, which would be necessary for the accurate separation of certain species or for the recognition of new species.

In the identification of this group the writer has found most helpful the excellent keys and descriptions of C. B. Wilson (1932) and the masterly monograph of Giesbrecht (1892). Monographs and papers by a number of other specialists have been consulted; these include: G. S. Brady, C. Claus, C. O. Esterly, G. P. Farran, R. Gurney, F. Kiefer, C. Dwight Marsh, G. O. Sars, R. B. S. Sewell, R. W. Sharpe, W. M. Wheeler, A. Willey.

In reviewing Table 3, one sees that there are certain species such as *Paracalanus parvus, Oithonina nana, Corycaeus venustus,* and *Temora turbinata,* that were found in almost all the different environments sampled. In contrast, there are species, such as *Clyclops prasinus,* which were taken only in fresh to brackish water, and *Calanus minor, Rhincalanus cornutus, Mecynocera clausi,* and *Heterorhabdus spinifrons* which occurred only in the open Gulf. Of the species listed in Table 3, ten were first reported from American Shores in the fairly recent (1932) publication of C. B. Wilson.

Order Amphipoda. The amphipods were poorly represented in the plankton, but on a few occasions, showed up in fair numbers in the coastal areas.

Order Stomatopoda. Larval stomatopods were very scarce in the collections and were taken only at the 10 and 20 fathom stations.

Order Decapoda. Sergestid shrimp (*Lucifer* sp.) were common in numbers in the collections from bay and coastal waters but not taken offshore.

Shrimp and crab larvae in various stages of growth appeared in almost all plankton tows. These forms are important constituents of the plankton and are, no doubt, of significance in the diet of plankton feeding animals.

Phylum Mollusca

Class Gastropoda. A great variety of gastropod larvae was taken, with some examples in almost every tow. Pteropoda were found only in the more offshore areas at Stations 5 to 8.

Class Pelecypoda. Pelecypod larvae appeared in collections from all the areas sampled but were by far the most numerous in inside and coastal waters.

Class Cephalopoda. Very young squid were taken in a few of the tows made in coastal water.

Phylum Chordata

Subphylum Tunicata. Members of this group, identified as *Appendicularia,* were present in fair numbers in almost every sample examined, ranging from the brackish estuary to the edge of the continental shelf.

A few *Salpa* were found in collections from the 10 and 40 fathom stations.

Subphylum Vertebrata. Fish eggs and, larvae were found in most plankton samples but always as a minor constituent.

TABLE 3.—Plankton of the Florida West Coast, Appearing in Collections Made at the Indicated Locations During the Period January to October, 1949. The Locations of Stations 1 to 8 and Localities A to L are given in Figure 1 and Tables 1 and 2.

	STATION								Other Localities
	1	2	3	4	5	6	7	8	
THALLOPHYTA									
CYANOPHYCEÆ									
Merismopedia sp.	x	x	...	...	...	...	...	...	
Glœcapsa sp.	x	x	...	...	...	...	...	...	
Trichodesmium erythræum Ehrenberg	x	x	x	x	x	x	x	x	C, E, F, I
—*thiebautii* Gomont	...	...	...	...	x	x	...	x	H, I
Microcoleus sp. (*tenerrimus ?*)	x	x	...	...	...	...	...	...	
Nostoc sp.	x	x	...	x	...	...	...	...	
Richelia sp.	...	...	...	...	x	...	x	...	
BACILLARIOPHYCEÆ									
Melosira sp.	x	x	x	x	x	x	x	x	G
Stephanopyxis sp.	...	...	...	...	...	...	x	x	
Skeletonema sp.	x	x	x	x	x	x	x	x	A, C, D
Thalassiosira sp.	...	...	...	...	...	...	...	x	
Coscinodiscus sp.	x	x	x	x	x	x	x	x	A, B, D, G, I, K
Asterolampra marylandica Ehrenberg	...	...	...	x	...	...	...	...	
Corethron sp.	x	...	x	...	x	x	x	x	
Rhizosolenia delicatula Cleve	...	x	x	...	...	...	x	...	
—*stolterfothii* H. Peragallo	x	...	x	x	x	x	x	x	B, E, F
—*robusta* Norman	...	...	x	x	x	x	x	x	C

TABLE 3 (Continued)

	STATION								Other Localities
	1	2	3	4	5	6	7	8	
—*calcar avis* M. Schultze	...	...	...	x	x	...	...	...	
—*alata* Brightwell	...	...	...	x	x	...	x	...	D
— sp.	x	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, K
Bacteriastrum sp.	...	...	x	x	x	x	x	x	A, B, C, E
Chætoceros coarctatus Lauder	...	...	...	...	x	x	x	x	
—*tortissimus* Gran	...	...	...	...	x	...	...	...	
— sp.	x	x	x	x	x	x	x	x	A, C, E, F, G
Eucampia cornuta Cleve	...	...	...	...	x	...	...	...	
Climacodium sp.	...	...	...	x	x	x	...	x	H, I
Streptotheca sp.	...	...	...	x	x	...	x	x	
Biddulphia mobiliensis Bailey	...	...	...	...	...	...	...	...	A
— sp.	...	x	x	x	x	...	...	x	
Hemiaulus sp.	...	...	...	x	x	x	x	x	A, D
Striatella sp.	x	...	x	x	x	x	x	...	A
Grammatophora sp.	x	...	x	x	...	...	...	...	
Licmophora sp.	...	...	...	...	...	...	x	...	
Fragilaria sp.	x	...	...	...	...	...	...	...	
Synedra sp.	x	...	...	...	...	...	...	...	
Thalassionema nitzschioides Grunow	...	...	...	x	...	...	...	...	
— sp.	...	x	x	x	x	x	x	...	C
Thalassiothrix sp.	x	x	x	x	x	x	x	x	A, C

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Asterionella japonica Cleve	x	x	x	x	x	x	...	...	
Navicula sp.	x	x	x	x	x	x	x	x	
Pleurosigma sp.	...	x	x	x	x	x	...	...	
Gyrosigma sp.	x	x	x	x	x	x	...	...	A, B, C, E, F
Nitzschia sp.	x	x	x	x	x	x	x	x	E, I
Surirella sp.	x	x	x	...	...	...	...	...	
CHLOROPHYCEÆ									
Closterium sp.	x	x	...	...	...	...	...	...	
Staurastrum sp.	x	x	...	...	...	...	...	...	
Micrasterias sp.	x	x	...	...	...	...	...	...	
Euastrum sp.	...	x	...	...	...	...	...	...	
Cosmarium sp.	x	x	...	...	...	...	...	...	
Xanthidium sp.	...	x	...	...	...	...	...	...	
Spirogyra sp.	x	...	...	...	...	...	...	...	
Unidentified filamentous algæ	x	x	...	...	...	...	...	...	
Scenedesmus sp.	x	x	...	...	...	...	...	...	
Pediastrum sp.	x	x	...	...	...	...	...	...	
Eudorina sp.	x	...	...	...	...	...	...	...	
Volvox sp.	x	x	...	...	...	...	...	...	
PROTOZOA									
MASTIGOPHORA									
Silicoflagellidae	...	...	...	x	x	...	...	...	

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Prorocentrum sp.	...	...	...	x	...	...	...	...	
Gymnodinium simplex (Lohmann)	x	x	x	x	x	...	...	...	Sarasota Bay
—*rhomboides* Schutt	...	...	...	...	x	...	...	...	
— sp. (*nelsoni ?*)	...	...	...	...	...	...	...	...	Sarasota Bay
— sp.	x	x	x	x	x	x	x	x	C, Sarasota Bay
Cochlodinium sp. (*virescens ?*)	...	...	...	...	...	...	...	...	Sarasota Bay
Polykrikos sp. (*schwartzi ?*)	...	...	...	...	...	...	...	...	Sarasota Bay
Dinophysis caudata Kent	...	...	...	x	x	x	...	...	G
— sp.	x	...	x	x	x	x	x	x	C, Sarasota Bay
Peridinium sp.	x	x	x	x	x	x	x	x	A, F, Sarasota Bay
Ceratium furca (Ehrneberg)	x	x	x	x	x	x	x	x	A, C, E, F, H, Sarasota Bay
—*extensum* (Gaurret)	...	...	...	...	...	...	x	x	
—*fusus* (Ehrenberg)	...	x	x	x	x	x	x	...	A, C, H
—*tripos* O. F. Muller	x	...	x	x	x	x	x	x	A, C, E, G, H
—*macroceros* (Ehrenberg)	...	...	...	x	x	x	x	...	I
—*trichoceros* (Ehrenberg)	x	x	x	x	x	x	x	x	A, C, D, E, F
— sp.	...	x	...	x	...	...	x	...	
Gonyaulax triacantha Jorgensen	...	...	...	...	...	...	...	...	Sarasota Bay
— sp.	x	x	x	x	x	x	x	...	Sarasota Bay
SARCODINA									
Foraminifera	...	...	x	x	x	...	x	...	H

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Radiolaria	...	...	x	x	x	...	x	x	G, H, I
CILIATA									
Plagiocampa marina Kahl	x	x	x	x	x	x	x	...	
Tintinnidæ	x	x	x	x	x	x	x	x	A, C, D
Euplotes sp.	x	...	x	x	x	...	...	x	E
CŒLENTERATA									
SIPHONOPHORA (several forms, some resembling *Diphyes* sp.)	...	...	x	x	x	x	x	x	
MEDUSÆ	x	...	x	x	x	x	x	x	B, D, F, G, H, I
PLATYHELMINTHES									
TURBELLARIA	x	...	x	x	x	x	...	...	B, C, E, J
ROTATORIA									
ROTIFERA	x	x	...	...	...	...	...	...	
CHÆTOGNATHA									
Sagitta enflata	...	...	...	...	x	x	x	x	
— sp. (probably *elegans* and *bipunctata*)	x	x	x	x	x	x	x	x	
ECHINODERMATA									
Pluteus and bipinnaria larvæ	...	...	...	x	x	x	x	x	E, H, I
ANNELIDA									
Chætopterus larvæ	...	...	...	...	...	...	...	...	G
Other polychæte larvæ	x	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, I, K

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
ATHROPODA									
CLADOCERA									
Diaphanosoma sp. (?)	...	x	x	x	x	x	...	...	D, G
Bosmina sp. (obtusirostris ?)	x	...	...	...	...	...	...	...	
Chydorus sp. (*sphæricus* ?)	x	...	...	...	...	...	...	...	
Camptocercus sp. (*rectirostris* ?)	x	...	...	...	...	...	...	...	
Evadnè sp. (*nordmanni* ?)	x	x	x	x	...	...	x	x	A, G, H, I
Podon sp. (*leuckarti* ?)	...	...	...	...	...	...	...	...	G
OSTRACODA	x	...	...	...	x	x	x	x	H, K
CIRRIPEDIA LARVÆ	x	x	x	x	x	...	...	...	H
COPEPODA									
Calanoida									
Calanus minor (Claus)	...	...	...	...	...	x	x	x	I
—*tenuicornis* Dana	...	...	...	...	...	...	x	x	
— sp.	...	...	...	...	x	...	x	x	H, I
Undinula vulgaris (Dana)	...	...	...	x	x	x	x	x	H
~~*Undinula vulgaris* (Dana)~~	...	...	...	~~x~~	~~x~~	~~x~~	~~x~~	x	~~H~~
Eucalanus attenuatus (Dana)	...	...	...	...	...	...	x	x	
—*monachus* Giesbrecht	x	...	x	x	x	x	x	x	D
Rhincalanus cornutus Dana	...	...	...	...	...	...	...	x	
Mecynocera clausi I. C. Thompson	...	...	...	...	...	...	x	x	I

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Paracalanus parvus Giesbrecht	x	x	x	x	x	x	x	x	B, C, D, E, F, G, H, I, J, K, L
— sp.						x			
Acrocalanus longicornis Giesbrecht					x		x	x	
Calocalanus pavo (Dana)						x	x	x	I
—*plumulosus* (Claus)						x	x	x	I
Clausocalanus arcuicornis (Dana)				x	x	x	x	x	H, I
Œtideus armatus (Boeck)							x	x	
Paraeuchæta sp.							x		
Xanthocalanus borealis Sars								x	
—*propinquus* Sars								x	
Brachycalanus atlanticus (Wolfenden)								x	
Scaphocalanus sp.							x		
Phænna spinifera Claus								x	
Centropages bradyi Wheeler								x	
—*furcatus* (Dana)			x	x	x	x	x	x	H, I, D
Diaptomus dorsalis Marsh		x							
—*mississippiensis* Marsh	x								
—*floridanus* Marsh	x								
Pseudodiaptomus coronatus Williams	x								
Temora stylifera (Dana)				x	x	x	x	x	H, I
—*turbinata* (Dana)		x	x	x	x	x	x	x	D, E, G, H, I, J

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Metridia brevicauda Giesbrecht								x	
—*lucens* Boeck								x	
Lucicutia flavicornis (Claus)							x	x	
Heterorhabdus spinifrons (Claus)							x	x	
Candacia pachydactyla (Dana)					x		x	x	I
Calanopia americana Dahl				x	x	x		x	D, I
Labidocera acutifrons (Dana)			x		x				F
—*æstiva* Wheeler	x	x	x	x	x				A, D, E, L
Pontella meadii Wheeler					x				H
Pontellina plumata Dana								x	
Pontellopsis villosus (Dana)					x				
Acartia danæ Giesbrecht						x	x	x	
—*tonsa* Dana	x	x	x	x					A, B, C, E, F, G, J, L
Undinopsis sp.								x	
Valdiviella sp.								x	
Heterocope sp.					x				
HARPACTICOIDA									
Longipedia coronata Claus				x	x				E
Canuella elongata C. B. Wilson		x			x				
Microsetella rosea (Dana)	x	x		x		x	x	x	H, I

TABLE 3 (Continued)

	Station								Other Localities
	1	2	3	4	5	6	7	8	
Euterpina acutifrons (Dana)	x	x	x	x	x	x	...	...	A, B, C, D, E, F, G, I, J
Laophonte sp.	...	...	...	...	x	...	...	...	
Macrosetella gracilis (Dana)	x	...	x	x	x	x	x	x	H, I
—*oculata* (Sars)	...	...	...	...	...	...	x	x	
Miracia efferata Dana	...	...	...	...	...	...	...	x	
Clytemnestra rostrata (Brady)	...	...	...	x	x	...	x	x	I
Unidentified Harpacticoida	x	x	x	x	x	x	...	...	A, D, E
CYCLOPOIDA									
Oithona plumifera Baird	...	...	...	...	x	x	x	x	H, I
Oithonina nana Giesbrecht	x	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, I, J, K, L
Cyclops sp.	x	x	x	x	...	x	x	...	B
Eucyclops prasinus (Fischer)	x	x	...	...	...	...	...	...	
—*serrulatus* (Fischer)	x	...	...	...	...	...	...	...	
Paralichomolgus sp.	x	...	...	...	...	...	...	...	
Oncæa conifera Giesbrecht	...	...	...	...	...	...	x	x	
—*minuta* Giesbrecht	...	...	x	x	x	x	x	x	B, H, I
—*venusta* Philippi	...	...	...	...	x	x	x	x	
Lubbockia squillimana Claus	...	...	...	...	...	...	x	x	
Corycæus elongatus Claus	...	...	...	...	x	...	x	x	
—*obtusus* Dana	...	...	...	...	...	...	x	...	

TABLE 3 (Continued)

	Station								Other Localities
	1	2	3	4	5	6	7	8	
—*speciosus* Dana	...	...	x	...	...	...	x	x	
—*danæ* Giesbrecht)	...	...	...	...	...	...	...	x	
—*ovalis* Claus (?)	x	...	...	...	...	...	x	...	
—*venustus* Dana	...	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, I, J
—*americanus* M. S. Wilson	x	...	x	x	x	x	x	...	G, H, I
— sp.	x	...	...	...	x	...	x	...	
Corycella carinata (Giesbrecht)	...	...	x	...	x	x	x	x	H, I
— sp.	...	...	...	...	...	...	x	...	
Sapphirina angusta Dana	...	...	...	...	...	...	x	x	
—*vorax* Giesbrecht	...	...	...	...	...	...	...	x	
—*nigromaculata* Claus	...	...	...	...	...	x	...	...	
— sp.	...	...	...	...	...	...	x	...	G, K
Copilia mirabilis Dana	...	...	...	...	...	x	x	x	
Monstrilloida									
Thaumaleus longispinosus Bourne	...	...	...	...	...	...	...	...	B
AMPHIPODA	...	x	x	...	...	x	...	...	H
STOMATOPODA									
Squilla larvæ	...	...	...	...	x	...	...	...	
Other stomatopod larvæ	...	...	...	...	x	x	...	...	D
DECAPODA									
Sergestid shrimp (*Lucifer* sp.)	x	x	x	x	x	x	...	...	B, D, K

TABLE 3 (Continued)

	Station 1	2	3	4	5	6	7	8	Other Localities
Shrimp larvæ	x	x	x	x	x	x	x	x	A, B, C, E, F, G, H
Crab (Porcellanid) larvæ	...	x	x	x	...	x	...	...	B, G
—(Brachyura) larvæ	x	x	x	x	x	x	x	x	B, D, E, F, G, H, K
MOLLUSCA									
GASTROPODA									
Gastropod larvæ	x	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, I, K, L
Pteropoda	...	...	...	...	x	x	x	x	
PELECYPODA									
Pecten (?) larvæ	x	x	x	x	...	...	...	...	D
Venus larvæ	x	x	x	x	...	...	...	...	G, J
Other pelecypod larvæ	x	x	x	x	x	x	x	x	A, B, C, D, E, F, G, H, I
CEPHALOPODA									
Squid larvæ	...	...	...	...	...	...	...	...	G, H
CHORDATA									
TUNICATA									
Appendicularia sp.	x	x	x	x	x	x	x	x	A, C, D, E, G, H, I, J, K
Salpa sp.	...	...	...	...	x	x	...	...	
VERTEBRATA									
Fish eggs	x	...	...	x	x	...	x	x	I
Fish larvæ	x	x	x	x	x	x	x	...	D, H

PLANKTON COUNTS AND VOLUMES

The counts and volumes given in Tables 4 and 5 would indicate that the waters of coastal Florida are poor in plankton. The highest count shown, that of a half million plankters per liter of water, does not compare favorably with counts of millions of organisms per liter, which are not unusual for the North Atlantic. We believe, however, that the variety of plankton in Florida's waters cannot be rivaled by that of northern waters. For example, a tow made Oct. 12, 1949, in which 1600 liters of water were strained, yielded 1.0 ml. of plankton material from which 33 species of copepods and 11 genera of diatoms were identified, plus several dinoflagellates and a variety of invertebrate larvae.

On the average, both the highest counts and the greatest plankton volumes were secured in coastal water at the 5 fathom station. In general, from that point offshore, the quantity of plankton varied inversely with the depth; however, the number of species present seems to vary in the same manner as the depth.

GENERAL SUMMARY

It has been stated that of all aquatic communities, that of marine coastal areas is the most cosmopolitan, including as it does not only neritic but also oceanic forms carried coastwards by currents, brackishwater and even freshwater forms carried down from the estuaries, epiphytes detached by wave action and lastly, bottom life swept up from the substratum. The plankton collections described in this paper, which number approximately 75, were taken throughout such a coastal environment and show —not the presence of a great abundance of plankton—but an exceedingly varied flora and fauna, with the dominant forms being the diatoms and the copepods. An attempt has been made to become generally familiar with the so-called normal or typical plankton constituents, their relative abundance and distribution. As the work continues, studies will be made to determine the nature of seasonal cycles or successions of plankton in these temperate to sub-tropical waters.

Particularly detailed records are being kept on the dinoflagellate population, with the possibility that fluctuations in their abundance may—when sufficient data are available—be related to certain definite biological, chemical or physical changes in the Gulf water and thus solve, to a certain extent, the mystery of the red tide in this area.

TABLE 4.—Total Plankton Counts in Number of Organisms per Liter of Water

Visit	Station							
	1	2	3	4	5	6	7	8
1 (May)	13,618	524,661	52,936	202,426	29,405	10,653	26,991	90
2 (June)	....	....	63,000	24,438	50,917	....	4,016	no visit
3 (June)	221,650	90,571	6,165	....	....	....	....	no visit
4 (July)	69,448	26,266	....	....	6,441	1,798	1,632	no visit
5 (August)	46,014	17,552	50,125	321,556	80,296	no visit	no visit	no visit
6 (September)	200,731	128,217	....	138,149	5,138	1,439	364	462
7 (October)	23,924	38,005	242,464	23,137	22,856	1,334	520	588
Average	95,898	137,545	~~82,839~~ 82,938	141,941	32,509	3,806	6,705	380

TABLE 5.—Plankton Displacement Volumes Expressed as Milliliters of Solids per Liter of Water, after Centrifuging Five Minutes at 2000 R.P.M.

Visit	Station							
	1	2	3	4	5	6	7	8
1 (May)	.0061	.0211	.0078	.0359	.0043	.0037	.0065	.0004
2 (June)	....	....	.0081	.0202	.0095	....	.0027	no visit
3 (June)	.0326	.0163	.0016	....	....	....	....	no visit
4 (July)	.0136	.0114	.0044	....	.0031	.0006	.0006	no visit
5 (August)	.0060	.0023	.0080	.0806	.0271	no visit	no visit	no visit
6 (September)	.0198	.0271	....	.0064	.0012	.0009	.0003	.0004
7 (October)	.0038	.0051	.0129	.0037	.0107	.0007	.0005	.0006
Average	.0137	.0139	.0071	.0294	.0093	.0015	.0021	.0005

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